



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 4Y9S  
Title : structure of an H300N mutant of potato epoxide hydrolase, StEH1  
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Deposited on : 2015-02-17  
Resolution : 2.00 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : trunk31020  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Refmac : 5.8.0158  
CCP4 : 7.0 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk31020

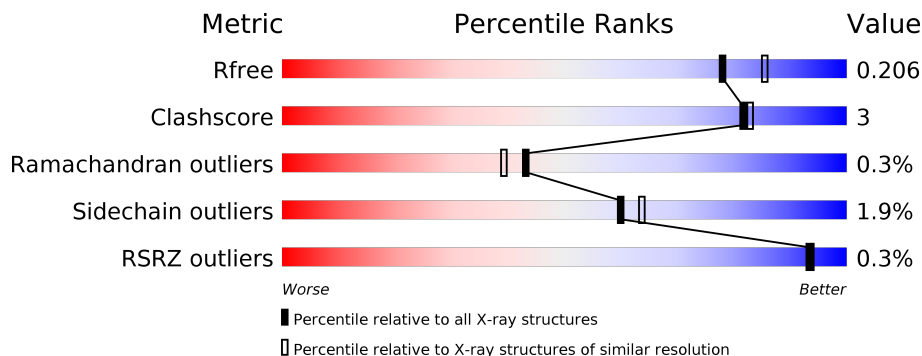
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*



The reported resolution of this entry is 2.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	111664	7193 (2.00-2.00)
Clashscore	122126	8267 (2.00-2.00)
Ramachandran outliers	120053	8166 (2.00-2.00)
Sidechain outliers	120020	8165 (2.00-2.00)
RSRZ outliers	108989	7011 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	328	 88% 9% ..
1	B	328	 % 90% 6% ..

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 5593 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Epoxide hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	320	Total	C	N	O	S	0	0	0
			2560	1679	424	452	5			
1	B	319	Total	C	N	O	S	0	0	0
			2551	1673	422	451	5			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	THR	-	expression tag	UNP Q41415
A	-5	SER	-	expression tag	UNP Q41415
A	-4	HIS	-	expression tag	UNP Q41415
A	-3	HIS	-	expression tag	UNP Q41415
A	-2	HIS	-	expression tag	UNP Q41415
A	-1	HIS	-	expression tag	UNP Q41415
A	0	HIS	-	expression tag	UNP Q41415
A	1	MET	-	expression tag	UNP Q41415
A	2	LYS	-	expression tag	UNP Q41415
A	300	ASN	HIS	engineered mutation	UNP Q41415
B	-6	THR	-	expression tag	UNP Q41415
B	-5	SER	-	expression tag	UNP Q41415
B	-4	HIS	-	expression tag	UNP Q41415
B	-3	HIS	-	expression tag	UNP Q41415
B	-2	HIS	-	expression tag	UNP Q41415
B	-1	HIS	-	expression tag	UNP Q41415
B	0	HIS	-	expression tag	UNP Q41415
B	1	MET	-	expression tag	UNP Q41415
B	2	LYS	-	expression tag	UNP Q41415
B	300	ASN	HIS	engineered mutation	UNP Q41415

- Molecule 2 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
2	A	268	Total 268	O 268	0	0
2	B	214	Total 214	O 214	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	56.02Å 96.04Å 121.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	51.36 – 2.00 51.36 – 2.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (51.36-2.00) 100.0 (51.36-2.00)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.61 (at 2.00Å)	Xtrriage
Refinement program	REFMAC 5.8.0073	Depositor
R, $R_{free}$	0.147 , 0.199 0.160 , 0.206	Depositor DCC
$R_{free}$ test set	2276 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	18.7	Xtrriage
Anisotropy	0.287	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 51.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5593	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	20.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.97% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z  > 5$	RMSZ	# $ Z  > 5$
1	A	1.01	5/2640 (0.2%)	0.94	5/3591 (0.1%)
1	B	0.91	0/2631	0.91	4/3580 (0.1%)
All	All	0.96	5/5271 (0.1%)	0.93	9/7171 (0.1%)

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	151	GLU	CD-OE1	6.73	1.33	1.25
1	A	227	GLY	CA-C	6.12	1.61	1.51
1	A	151	GLU	CG-CD	5.90	1.60	1.51
1	A	143	GLU	CD-OE1	5.44	1.31	1.25
1	A	165	GLU	CD-OE2	5.29	1.31	1.25

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	53	ARG	NE-CZ-NH1	8.08	124.34	120.30
1	A	53	ARG	NE-CZ-NH2	-7.76	116.42	120.30
1	B	157	ARG	NE-CZ-NH2	-6.52	117.04	120.30
1	A	60	ARG	NE-CZ-NH2	-6.41	117.10	120.30
1	B	120	ASP	CB-CG-OD1	6.36	124.03	118.30
1	B	306	ARG	NE-CZ-NH2	-5.84	117.38	120.30
1	A	50	ARG	NE-CZ-NH1	5.79	123.19	120.30
1	B	72	ASP	CB-CG-OD2	-5.74	113.13	118.30
1	A	84	ASP	CB-CG-OD1	5.16	122.94	118.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2560	0	2533	13	0
1	B	2551	0	2520	15	0
2	A	268	0	0	2	1
2	B	214	0	0	5	1
All	All	5593	0	5053	28	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (28) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:306:ARG:NH2	1:A:309:GLU:OE2	2.18	0.77
1:B:224:GLU:OE1	2:B:514:HOH:O	2.03	0.76
1:B:208:SER:HB3	2:B:543:HOH:O	1.90	0.71
1:B:121:LYS:NZ	2:B:529:HOH:O	2.12	0.57
1:B:179:LYS:HE3	1:B:200:ILE:O	2.05	0.57
1:B:121:LYS:HE2	2:B:417:HOH:O	2.05	0.56
1:B:18:LEU:HD23	1:B:18:LEU:C	2.28	0.53
1:A:11:VAL:HG23	1:A:11:VAL:O	2.10	0.51
1:A:41:ARG:HH21	1:A:215:GLU:CD	2.12	0.51
1:B:319:GLN:HA	1:B:319:GLN:OE1	2.11	0.50
1:B:179:LYS:HE2	1:B:200:ILE:HB	1.96	0.47
1:A:208:SER:HB3	2:A:546:HOH:O	2.15	0.46
1:A:151:GLU:CD	1:A:151:GLU:N	2.69	0.46
1:B:18:LEU:CD1	1:B:92:ILE:HG21	2.47	0.45
1:B:246:ALA:N	1:B:247:PRO:CD	2.80	0.44
1:B:121:LYS:CE	2:B:417:HOH:O	2.63	0.44
1:A:93:ALA:N	1:A:94:PRO:CD	2.80	0.44
1:B:18:LEU:HD23	1:B:19:ALA:N	2.33	0.43
1:B:46:TYR:CD2	1:B:311:SER:HB3	2.53	0.43
1:A:151:GLU:H	1:A:151:GLU:CD	2.22	0.43
1:A:240:ILE:HG21	1:A:240:ILE:HD13	1.84	0.42
1:A:109:LEU:HD13	1:A:130:VAL:HG11	2.02	0.42
1:A:37:TRP:CG	1:A:38:TYR:N	2.87	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:268:TYR:CE2	1:A:274:LYS:HE2	2.55	0.41
1:A:171:ILE:HG22	1:A:175:SER:HB2	2.02	0.40
1:A:90:GLU:CG	2:A:414:HOH:O	2.68	0.40
1:B:240:ILE:HA	1:B:240:ILE:HD12	1.92	0.40
1:B:78:ILE:HG23	1:B:79:LEU:HD22	2.03	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:409:HOH:O	2:B:426:HOH:O[2_674]	2.15	0.05

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	318/328 (97%)	311 (98%)	6 (2%)	1 (0%)	43	39
1	B	317/328 (97%)	310 (98%)	6 (2%)	1 (0%)	43	39
All	All	635/656 (97%)	621 (98%)	12 (2%)	2 (0%)	43	39

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	34	PRO
1	A	34	PRO

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	267/275 (97%)	261 (98%)	6 (2%)	55	58
1	B	266/275 (97%)	262 (98%)	4 (2%)	67	72
All	All	533/550 (97%)	523 (98%)	10 (2%)	60	64

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	LYS
1	A	90	GLU
1	A	109	LEU
1	A	121	LYS
1	A	134	LYS
1	A	193	LYS
1	B	18	LEU
1	B	133	SER
1	B	138	LYS
1	B	179	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

### 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	320/328 (97%)	-0.61	0 <a href="#">100</a>   <a href="#">100</a>	9, 15, 28, 48	0
1	B	319/328 (97%)	-0.50	2 (0%) <a href="#">89</a>   <a href="#">88</a>	9, 19, 36, 52	0
All	All	639/656 (97%)	-0.55	2 (0%) <a href="#">93</a>   <a href="#">93</a>	9, 17, 34, 52	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	291	GLU	2.5
1	B	133	SER	2.2

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

### 6.5 Other polymers [i](#)

There are no such residues in this entry.